CLAIMS

What is claimed is:

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1. An optical frequency filter comprising:

a frequency dependent disperser that disperses an input optical signal to form a dispersed signal having a plurality of frequencies;

a frequency selective modulator that modulates at least one of the plurality of frequencies; and

a frequency dependent combiner that combines the frequencies in the dispersed signal to form an intensity modulated output signal.

2. The filter of Claim 1, wherein the transmitted power of light through the filter is a varying function with respect to frequency over a selected bandwidth.

3. The filter of Claim 1, wherein transmission of light through the filter is a monotonically varying function with respect to frequency over a selected bandwidth.

4. The filter of Claim 3, wherein the transmission of light through the filter is linear as a function of frequency over a selected bandwidth.

5. The filter of Claim 1, wherein the modulation of light depends on time.

6. The filter of Claim 1, further comprising a circulator that is optically coupled to an input optical waveguide and the disperser.

7. The optical frequency filter of Claim 1, wherein the frequency dependent disperser comprises a device having time delays which depend on frequency.

8. The filter of Claim 7, wherein the disperser comprises a fiber grating having a Bragg frequency that is an exponential function of position.

9. The filter of Claim 1, wherein the modulator and the combiner comprise a grating.

10. The optical frequency filter of Claim 1, wherein the frequency dependent disperser comprises a device having a plurality of one of positions and angles which depend on frequency.

11. The optical frequency filter of Claim 10, wherein the frequency dependent disperser comprises a diffraction grating.

12. The optical frequency filter of Claim 10, wherein the frequency dependent disperser comprises a prism.

13. The optical frequency filter of Claim 10, wherein the frequency dependent disperser comprises an array of waveguide gratings.

14. The optical frequency filter of Claim 10, wherein the frequency dependent disperser comprises a modified waveguide grating router.

15. The optical frequency filter of Claim 1, wherein the frequency selective modulator comprises an attenuator.

16. A frequency modulation (FM) to intensity modulation (IM) converter comprising:

a frequency dependent disperser that disperses a frequency modulated light signal into a plurality of frequencies;

a frequency selective modulator that modulates at least one of the plurality of frequencies; and

a frequency dependent combiner that combines the dispersed and attenuated frequencies to form an intensity modulated output signal.

17. The converter of Claim 16 wherein transmission of light through the converter is linear as a function of frequency over a selected bandwidth.

18. The converter of Claim 16 further comprising an input optical fiber, a fiber grating and an output optical fiber.

19. The converter of Claim 18 wherein the disperser and combiner comprises a fiber grating.

20. The converter of Claim 18 wherein the modulator is coupled to at least one of the disperser and combiner.

21. The converter of Claim 16 further comprising a fiber grating and at least one device that allows light to propagate in a predetermined direction.

22. The converter of Claim 21 wherein the device that allows light to propagate in a predetermined direction further comprises at least one circulator, the circulator being coupled to the disperser and the combiner.

23. The converter of Claim 16 further comprising a mirror and a grating that forms the disperser and the combiner such that the mirror reflects the dispersed light from the grating onto the grating.

24. The converter of Claim 25, wherein the mirror is disposed at an angle with respect to the grating such that the referenced, dispersed light is offset from the frequency modulated light signal which forms the input to the converter.

25. The converter of Claim 23, wherein the grating comprises a waveguide grating router.

26. The converter of Claim 23, wherein the grating comprises a diffraction grating.

27. An optical communication system comprising:

an optical FM source;

an optical transmission link;

an FM to IM converter including a frequency dependent disperser to disperse light such that a plurality of frequencies are coupled to a frequency selective modulator that modulates an intensity of one or more frequencies and a frequency dependent combiner to produce an output signal that is linear with frequency over a selected bandwidth; and

a detector to detect IM signals.

28. A method to convert FM signals to IM signals, comprising the steps of:

dispersing an input optical signal using a frequency dependent disperser to form a dispersed signal having a plurality of frequencies;

modulating the optical signal using a frequency selective modulator that alters a magnitude of one of the plurality of frequencies; and

combining the optical signal using a frequency dependent combiner to form an intensity modulated output signal.

29. The method of Claim 28, wherein the intensity modulated output signal is linear with frequency over a selected bandwidth.

30. The method of Claim 28, providing a frequency dependent deflector that modulates the dispersed frequencies as a function of spatial position such that the modulated output signal is linear with frequency.

31. A method of filtering an optical signal comprising the steps of:

dispersing an input optical signal using a frequency dependent disperser to form a dispersed signal having a plurality of frequencies;

modulating the optical signal using a frequency selective modulator that modulates one of the plurality of frequencies; and

combining the optical signal using a frequency dependent combiner to form an output signal that varies with frequency over a selected bandwidth.

32. The method of Claim 31 further comprising collecting the input optical signal from a sample and forming a spectrum with the output signal.

33. The method of Claim 31 further comprising forming a plurality of filters in series or parallel, each filter having a disperser, an attenuator and a combiner.

34. A method to shape the transmission of a signal with respect to frequency comprising the steps of:

dispersing an input optical signal using a frequency dependent disperser to form a dispersed signal having a plurality of frequencies;

modulating the optical signal using a frequency selective modulator that modulates at least one of the plurality of frequencies; and

combining the optical signal using a frequency dependent combiner to form an output signal that is linear with frequency over a selected bandwidth.